

Listing of the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1. (Previously Presented) An echo canceller comprising:

a combiner for combining a secondary audio signal and a far end primary telephony signal into a single combined reference signal, wherein the secondary audio signal comprises secondary near end acoustic and electrical signals; and

an adaptive filter coupled to the combiner for receiving the single combined reference signal as input, the adaptive filter having filter coefficients adapted to cancel a combination of an electrical and an acoustical echo in a near end signal by modeling in parallel the electrical echo, caused by imperfect impedance matching of network transmission sections, comprising at least a portion of the primary telephony signal and the acoustical echo comprising at least a portion of the secondary audio signal.
2. (Original) The echo canceller of claim 1 wherein said adaptive filter comprises a finite impulse response filter.
3. (Previously Presented) The echo canceller of claim 2 wherein the finite impulse response filter comprises a linear transversal filter.
4. (Previously Presented) The echo canceller of claim 1 further comprising double talk logic to detect speech in the near end signal in presence of the secondary audio signal, said double talk logic controlling filter adaptation of the adaptive filter as a function of detection of speech in the near end signal.

5. (Original) The echo canceller of claim 1 wherein said secondary audio signal comprises a pulse metering tone.

6. (Original) The echo canceller of claim 1 further comprising a buffer, coupled to input of said adaptive filter, to combine said secondary audio signal and said primary telephony signal.

7. (Original) The echo canceller of claim 6 further comprising a decimator that downsamples the secondary audio signal to match a sample rate of the primary telephony signal.

8. (Original) The echo canceller of claim 6 wherein said adaptive filter generates an echo estimate of the combined secondary audio signal and the primary telephony signal, the cancellation of the echo in the near end signal being a function of the echo estimate.

9. (Original) The echo canceller of claim 8 further comprising a difference operator to subtract the echo estimate of said combined secondary audio signal and said primary telephony signal from the near end signal.

10. (Original) The echo canceller of claim 9 wherein output of said difference operator is feedback to the adaptive filter as an error signal for filter adaptation.

11. (Previously Presented) An echo canceller, comprising:

an adaptive filter having filter coefficients adapted to cancel an echo in a near end signal, the echo comprising an acoustic echo and an electrical echo, wherein the adaptive filter models in parallel the acoustic echo and the electrical

echo and the filter coefficients are adapted to cancel a combination of the acoustic echo and the electrical echo, caused by imperfect impedance matching of network transmission sections.

12. (Original) The echo canceller of claim 11 wherein said acoustic echo comprises at least a portion of a secondary audio signal broadcast by a speaker and received by a near end microphone coupled to said echo canceller.

13. (Original) The echo canceller of claim 12 wherein a set top box generates said secondary audio signal.

14. (Original) The echo canceller of claim 12 wherein said electrical echo comprises at least a portion of a far end telephony signal.

15. (Original) The echo canceller of claim 14 further comprising a buffer, coupled to input of said adaptive filter, to combine said secondary audio signal and said far end telephony signal.

16. (Original) The echo canceller of claim 15 further comprising a decimator that downsamples said secondary audio signal to match a sample rate of said far end telephony signal.

17. (Original) The echo canceller of claim 15 wherein said adaptive filter generates an echo estimate of said combined secondary audio signal and said far end telephony signal, said echo canceller being a function of said echo estimate.

18. (Original) The echo canceller of claim 17 wherein said adaptive filter comprises a finite impulse response filter.

19. (Previously Presented) The echo canceller of claim 18 wherein the finite impulse response filter comprises a linear transversal filter.

20. (Original) The echo canceller of claim 17 further comprising a difference operator to subtract the echo estimate of said combined secondary audio signal and said far end telephony signal from the near end signal.

21. (Previously Presented) The echo canceller of claim 12 further comprising double talk logic to detect speech in the near end signal in presence of the secondary audio signal, wherein said double talk logic controls filter adaptation of the adaptive filter as a function of detection of speech in the near end signal.

22. (Previously Presented) A data transmission system, comprising:
a first telephony device that outputs a far end signal; and
a second telephony device coupled to the first telephony device, the second telephony comprising an adaptive filter having filter coefficients adapted to cancel an echo in a near end signal, the echo comprising an acoustic echo and an electrical echo, wherein the adaptive filter models in parallel the acoustic echo and the electrical echo and the filter coefficients are adapted to cancel a combination of the acoustic echo and the electrical echo, caused by imperfect impedance matching of network transmission sections.

23. (Original) The data transmission system of claim 22 wherein said second telephony device comprises a speaker for broadcasting a secondary audio signal, said acoustic echo comprising at least a portion of said broadcast secondary audio signal received by a near end microphone of said second telephony device.

24. (Original) The data transmission system of claim 23 wherein said second telephony device comprises a set top box, wherein said set top box generates said secondary audio signal.

25. (Original) The data transmission system of claim 23 wherein said electrical echo comprises at least a portion of a far end telephony signal.

26. (Original) The data transmission system of claim 25 wherein said secondary telephony device further comprises a decimator that downsamples said secondary audio signal to match a sample rate of said far end telephony signal.

27. (Original) The data transmission system of claim 25 wherein said secondary telephony device further comprises a buffer, coupled to input of said adaptive filter, for combining said secondary audio signal and said far end telephony signal.

28. (Original) The data transmission system of claim 27 wherein said adaptive filter generates an echo estimate of said combined secondary audio signal and said far end telephony signal.

29. (Original) The data transmission system of claim 28 wherein said adaptive filter comprises a finite impulse response filter.

30. (Previously Presented) The data transmission system of claim 29 wherein the finite impulse response filter comprises a linear transversal filter.

31. (Original) The data transmission system of claim 28 wherein said second telephony device further comprises a difference operator to subtract the echo estimate of

said combined secondary audio signal and said far end telephony signal from the near end signal.

32. (Previously Presented) The data transmission system of claim 23 wherein said second telephony device further comprises double talk logic to detect speech in the near end signal in presence of the secondary audio signal, wherein said double talk logic controls filter adaptation of said adaptive filter as a function of the detection of speech in the near end signal.

33. (Previously Presented) A method of canceling an echo in a near end signal, said echo having a primary telephony component and a secondary audio component, the method comprising:

combining a primary telephony signal and a secondary audio signal to form a single reference signal;

adaptively filtering the reference signal using filter coefficients adapted for canceling a combination of an acoustic echo and an electrical echo by modeling in parallel the acoustic echo and the electrical echo, caused by imperfect impedance matching of network transmission sections; and

subtracting the filtered reference signal from the near end signal.

34. (Original) The method of claim 33 further comprising re-sampling said secondary audio signal to match a sample rate of said primary telephony signal prior to combining said primary telephony and secondary audio signal.

35. (Previously Presented) The method of claim 33 further comprising detecting speech in the near end signal in presence of the secondary audio signal and controlling filter adaptation as a function of the detection of the near end speech.

36. (Original) The method of claim 33 wherein the adaptive filtering of the reference signal comprises generating an estimate of said echo as a function of a transfer function of electrical and acoustic echo paths.

37. (Previously Presented) An echo canceller for canceling an echo in a near end signal, said echo having a primary telephony component and a secondary audio component, comprising:

combining means for combining a primary telephony signal and a secondary audio signal to form a single reference signal;

filtering means for adaptively filtering the reference signal, the filtering means having filter coefficients that are determined to cancel a combination of an acoustic echo and an electrical echo, wherein the adaptive filter models in parallel the acoustic echo and the electrical echo, caused by imperfect impedance matching of network transmission sections; and

means for subtracting the filtered reference signal from the near end signal.

38. (Original) The canceller of claim 37 further comprising means for re-sampling said secondary audio signal to match a sample rate of said primary telephony signal prior to combining said primary telephony and secondary audio signal by the combining means.

39. (Previously Presented) The echo canceller of claim 37 further comprising means for detecting speech in the near end signal in presence of the secondary audio signal and means for controlling filter adaptation of the filtering means as a function of the detection of near end speech.